

Lordiphosa denticeps Species-Group from Yunnan, China: Description of Four New Species, and Phenomena of Geographical Replacement (Diptera: Drosophilidae)

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Abstract: Four new species of *Lordiphosa denticeps* species-group are reported from Yunnan, China, namely *Lordiphosa grucollara* sp.nov., *Lordiphosa eminens* sp.nov., *Lordiphosa incidens* sp.nov. and *Lordiphosa piliferous* sp.nov. The distribution of the species of *denticeps* species-group shows distinct geographical replacement.

Key words: Diptera; Drosophilidae; *Lordiphosa*; *denticeps* species-group; New species; Distribution; Yunnan

云南拱背果蝇属双齿拱背果蝇种组—— 四新种记述及地理替代现象 (双翅目: 果蝇科)

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摘要: 概述了拱背果蝇属 (*Lordiphosa*) 中双齿拱背果蝇种组 (*denticeps* species-group) 的分类状况, 并记述了分布在云南省的 4 个新种, 即鹤颈拱背果蝇 (*Lordiphosa grucollara* sp.nov.), 突拱背果蝇 (*Lordiphosa eminens* sp.nov.), 凹缘拱背果蝇 (*Lordiphosa incidens* sp.nov.) 和具毛拱背果蝇 (*Lordiphosa piliferous* sp.nov.)。对目前在云南发现的该种组 10 个物种的地理分布做了初步分析, 结果显示其分布呈明显的地理替代。模式标本均藏于北京大学生命科学学院。

关键词: 双翅目; 果蝇科; 拱背果蝇属; 双齿拱背果蝇种组; 新种; 地理分布; 云南

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The *denticeps* species-group was originally established within the subgenus *Hirtodrosophila* of the genus *Drosophila* by Okada (1967), including two species: *Drosophila* (*Hirtodrosophila*) *denticeps* (Okada et Sasakawa, 1956) and *Drosophila* (*Hirtodrosophila*) *triparita* (Okada, 1966). Okada (1971) added two new species into this group, i.e., *Drosophila* (*Hirto-*

drosophila) *kurokawai* and *Drosophila* (*Hirtodrosophila*) *paradenticeps*. Putting those four species into systematic and biogeographical analyses, Okada found that the *denticeps* species-group had originated in the Southeast Asiatic Continent. However, Okada (1990) changed the taxonomic status of this species-group and assigned it as a new synonym of *nigricolor*

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species-group, Laštovka et Máca, 1978 (subgenus *Lordiphosa* Basden of genus *Drosophila* Fallén). The subgenus *Lordiphosa* was elevated to generic rank by Grimaldi (1990) on the basis of the result of his cladistic analysis of the family Drosophilidae. Zhang (1993) revised the *denticeps* species-group as a valid species-group of the genus *Lordiphosa* and added four new species from China in it. The recently phylogenetic analyses of *Lordiphosa* and its relationships in Drosophilidae exactly showed that the *denticeps* species-group is monophyletic group of *Lordiphosa* proper (Hu & Toda, 2001). There are ten described species in this species-group till now. Almost all of the species are distributed in China (mostly in Yunnan, 6 species), except for *Lordiphosa tripartita* (Nepal) and *Lordiphosa kurokawai* (Japan). In this paper, four new species were reported also from Yunnan, China. All of the types were deposited in College of Life Sciences, Peking University.

The distribution of the species of *denticeps* species-group in Yunnan shows distinct geographical replacement (Fig.1). As shown on the map, *Lordiphosa grucollara*, *Lordiphosa incidens* and

Lordiphosa piliferous are distributed in Mount Huan-glian of Lüchun County (southeastern part of Yunnan). They are replaced by *Lordiphosa vittata*, *Lordiphosa cultrata* and *Lordiphosa ramula* in Kunming. *Lordiphosa falsiramula* is distributed in Dali, *Lordiphosa neokurokawai* is in Laowo of Liuku (also in Kunming) and *Lordiphosa eminens* is in Pianma of Lushui County. In the far northwestern Deqin County on high mountains, *Lordiphosa degenensis* was found in 1993. It is obvious that Yunnan Province of China is a center of speciation of *Lordiphosa denticeps* species-group.

1 *Lordiphosa grucollara* sp. nov. (Fig.2: A – D)

Diagnosis: Paramere (Fig.2: C, D) caudally hook-shaped, like curved crane neck; anteriorly sclerotized, broad.

Head: Eye dark red, with thin piles. Ocellar triangle light brown; ocelli yellow. Frontal vitta dark yellow. Fronto-orbital plate dark yellow, with a few setulae. Face dark yellow; carina low, basally broad. Clypeus light brown. Gena dark yellow. Occiput

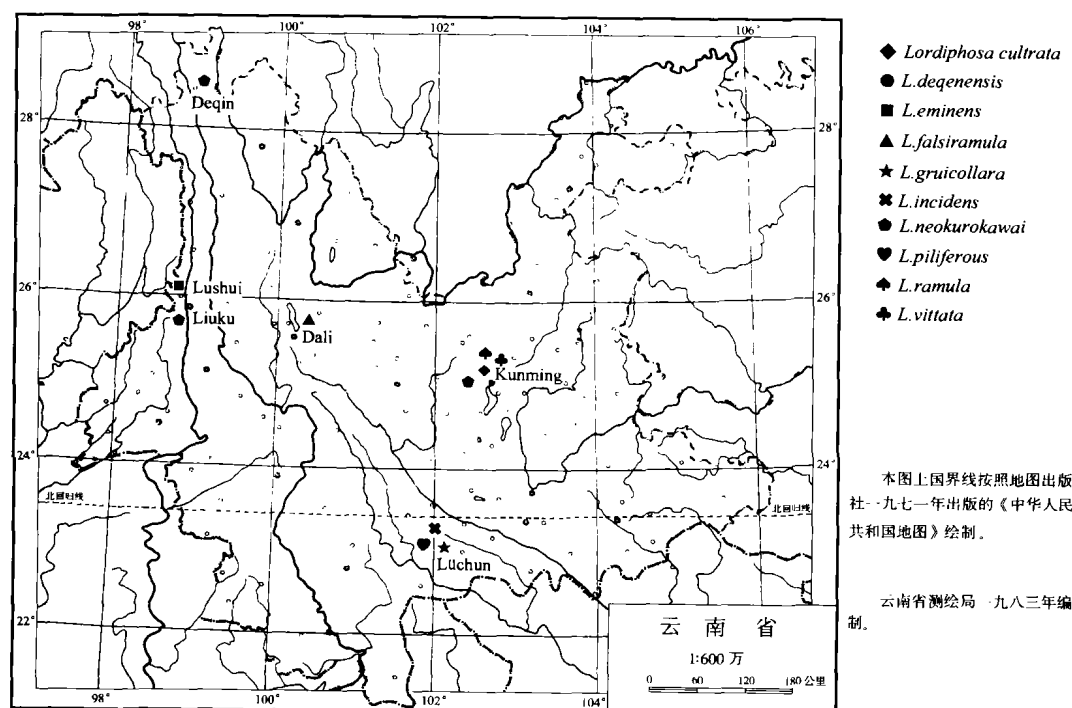


Fig.1 The distribution of species of *Lordiphosa denticeps* species-group in Yunnan

brown. Pedicel dark yellow, with 2 stout setae; 1st flagellomere yellow; terminal bifurcation of arista moderate. Palpus yellow, with 1 prominent apical and several lateral setae.

Thorax: Scutum dark yellow, caudally brown. Scutellum brown. Mesopleuron dark yellow. Postpronotal lob dark yellow; postpronotal setae 2, subequal. Acristichal setulae in 4 rows. Basal scutellar setae divergent; apicals convergent and crossed.

Wing: Hyaline, dark yellow. Veins brown; r-m and dm-cu crossveins clear. R_{2+3} slightly curved to costa at tip. R_{4+5} and M_1 parallel. C_1 setae 2, subequal. Halter pale yellow.

Legs: Dark yellow. Apical setae on fore and mid tibiae; preapical setae on all tibiae. Fore 1st tarsomere slightly longer than 3 succeeding tarsomeres together; mid and hind 1st tarsomeres as long as the rest together.

Abdomen: Tergites dark brown. Sternites dark yellow.

Male Terminalia: Epandrium (Fig.2: A) pubescent except for anterior margin and ventral lobe; with ca. 15 setae laterally and dorsally; ventral lobe apically pointed, with ca. 7 setae. Surstylus (Fig.2: A) with ca. 17 primary prenisetae on nearly entire length of distal margin; with a few spines on inner surface and a few setulae caudoventrally. Cercus (Fig.2: A, B) oval, entirely pubescent; with ca. 22 long setae and a tuft of ca. 7 short, stout setae on caudoventral corner. Hypandrium (Fig.2: C, D) somewhat triangular, without paramedian spines. Gonopods (Fig.2: C, D) fused, surrounding aedeagus and paramere dorsally. Aedeagus (Fig.2: C, D) distally somewhat dilated and hirsute. Apodeme (Fig.2: C, D) yellow, shorter than aedeagus.

Measurements (mm): BL = 2.17 (2.04 - 2.40); ThL = 1.04 (1.00 - 1.11); WL = 2.65 (2.54 - 2.80); WW = 1.11 (1.06 - 1.16).

Indices: arb = 4 - 5/2; FW/HW = 0.51 (0.48 - 0.55); ch/o = 0.19 (0.17 - 0.22); prorb = 0.80 (0.71 - 0.89); rorb = 0.34 (0.25 - 0.55); vb = 0.52 (0.47 - 0.58); dcl = 0.57 (0.54 - 0.61); setl = 1.28 (1.23 - 1.33); sterno = 0.47 (0.41 -

0.51); orbito = 0.60 (0.54 - 0.64); dcp = 0.59 (0.55 - 0.61); setlp = 1.11 (1.06 - 1.18); C = 3.73 (3.53 - 3.86); 4c = 0.62 (0.60 - 0.63); 4v = 1.57 (1.47 - 1.68); 5x = 1.66 (1.36 - 1.83); ac = 2.23 (2.13 - 2.40); M = 0.48 (0.42 - 0.53); C3F = 0.45 (0.43 - 0.48).

Holotype: ♂, China, Mount Huanglian, Lüchun County, Yunnan Province, alt. ca. 1 880 m, 9 - III - 1995, coll. ZHANG Wen-xia.

Paratype: 3♂, same data as holotype.

Distribution: China (Yunnan).

Relationship: This species belongs to *denticeps* species-group, resembles *Lordiphosa denticeps* (Okada et Sasakawa, 1956) in the character of the tufts of stout setae on caudoventral corner of cercus, but can be distinguished from the latter in the special structure of paramere, i.e., the paramere of this new species is specifically hook-shaped like curved crane neck and anteriorly sclerotized and broad while that of *Lordiphosa denticeps* is bifurcated and not hook-shaped apically.

Etymology: Referring to paramere caudally hook-shaped, like neck of crane.

2 *Lordiphosa eminens* sp. nov. (Fig.3: A - D)

Diagnosis: Cercus (Fig.3: C, D) ventrally pointed, with ca. 7 stout setae on caudoventral corner. Gonopods (Fig.3: C, D) fused, with a slender process on caudoventral corner.

Head: Eye dark yellow, with thin piles. Ocellar triangle yellow; ocelli yellow. Frontal vitta dark yellow; without interfrontal setae. Fronto-orbital plate dark yellow. Face dark yellow; carina high, anteriorly reaching buccal margin. Clypeus yellow. Gena dark yellow. Occiput brown. Pedicel dark yellow, with 2 stout setae; 1st flagellomere yellow; terminal bifurcation of arista moderate. Palpus yellow, with 1 prominent apical seta.

Thorax: Dark yellow. Postpronotal lob dark yellow; postpronotal setae 2, lower one longer. Acristichal setulae in 4 rows. Basal scutellar setae divergent; apicals convergent and crossed.

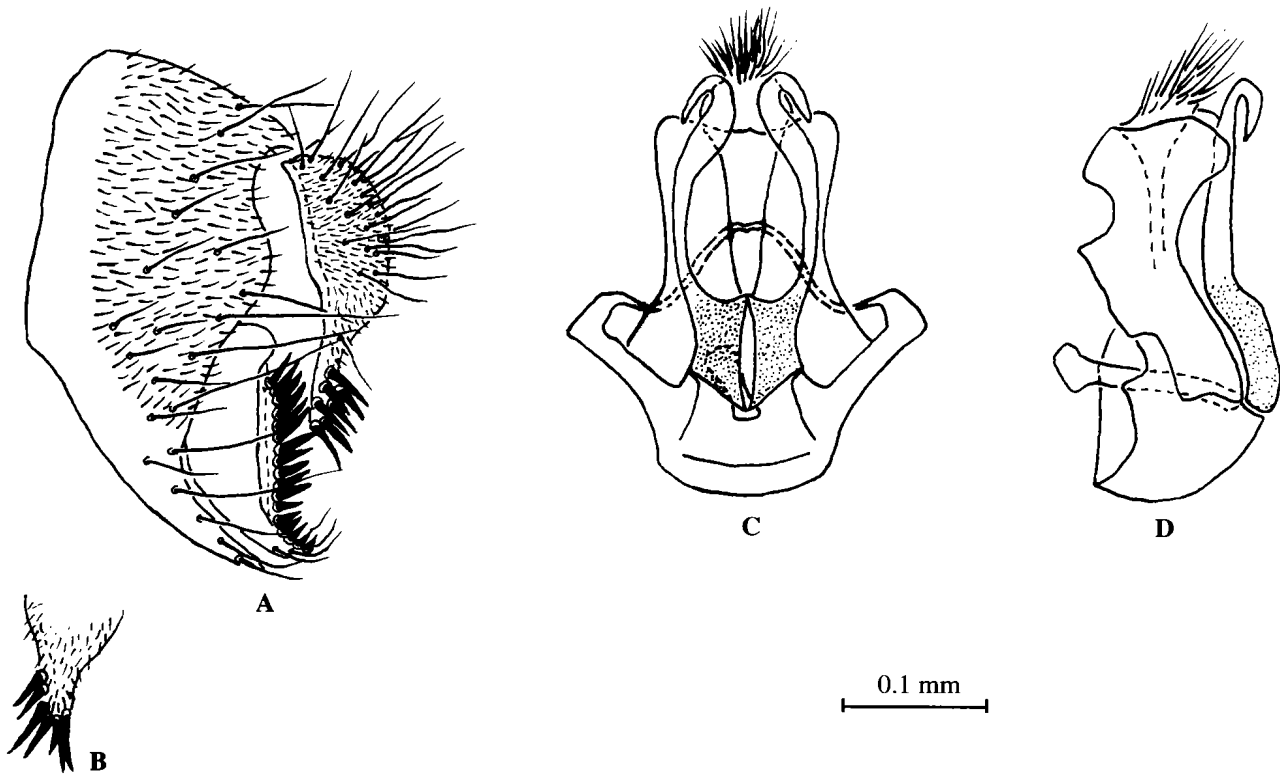


Fig.2 *Lordiphosa gruicollara* sp. nov.

A. Epandrium, cercus and surstylus, in lateral view; B. Cercus (ventral part); C. Aedeagus, paramere, apodeme, gonopod and hypandrium, in ventral view; D. Aedeagus, paramere, apodeme, gonopod and hypandrium, in lateral view.

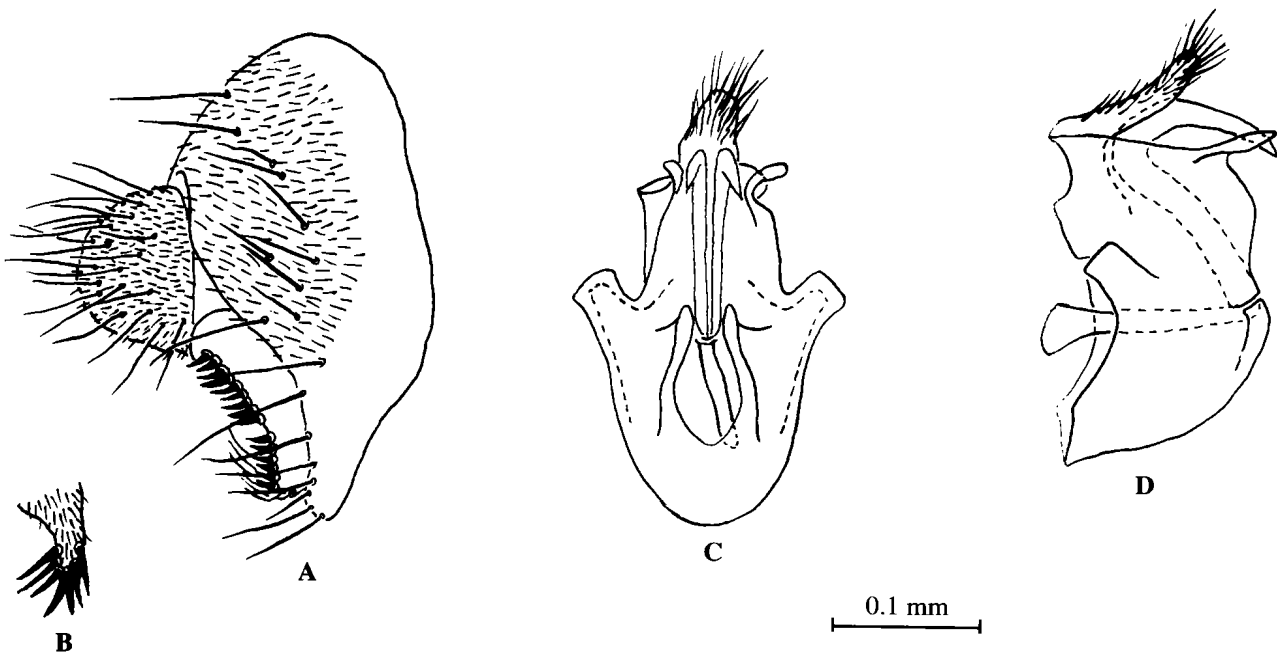


Fig.3 *Lordiphosa eminens* sp. nov.

A. Epandrium, cercus and surstylus, in lateral view; B. Cercus (ventral part); C. Aedeagus, paramere, apodeme, gonopod and hypandrium, in ventral view; D. Aedeagus, paramere, apodeme, gonopod and hypandrium, in lateral view.

Wing: Hyaline, dark yellow. Veins brown; r-m and dm-cu crossveins clear. R_{2+3} slightly curved to costa at tip. R_{4+5} and M_1 parallel. C_1 setae 2, subequal. Halter yellow.

Legs: Dark yellow. Apical setae on fore and mid tibiae; preapical setae on all tibiae. Fore 1st tarsomere slightly longer than 3 succeeding tarsomeres together; mid and hind 1st tarsomeres as long as the rest together.

Abdomen: Tergites dark yellow. Sternites dark yellow.

Male Terminalia: Epandrium (Fig.3: A) whitish yellow, transparent, pubescent except for anterior margin and ventral lobe; with *ca.* 11 setae laterally and dorsally; ventral lobe with *ca.* 7 setae on caudal margin. Surstylus (Fig.3: A) somewhat rectangular; with *ca.* 15 primary prensisetae arranging in concave row on nearly entire length of distal margin, submedially not continuous; with a few spines on inner surface and a few setulae caudoventrally. Cercus (Fig.3: A, B) oblate, entirely pubescent; with *ca.* 21 long setae. Hypandrium (Fig.3: C, D) somewhat triangular, without paramedian spines. Paramere (Fig.3: C, D) bow-shaped in lateral view, caudoapically pointed, anterior part articulated to hypandrium. Aedeagus (Fig.3: C, D) distally strongly hirsute. Apodeme (Fig.3: C, D) dark brown.

Measurements (mm): BL = 2.14; ThL = 1.06; WL = 2.52; WW = 1.08.

Indices: arb = 4/2; FW/HW = 0.49; ch/o = 0.20; prorb = 0.75; rorb = 0.30; vb = 0.35; dcl = 0.66; sctl = 1.41; sterno = 0.50; orbito = 0.54; dcp = 0.62; sctlp = 1.06; C = 4.00; 4c = 0.52; 4v = 1.36; 5x = 1.63; ac = 1.83; M = 0.46; C3F = 0.28.

Holotype: ♂, China, Pianmayakou, Lushui County, Yunnan Province, alt. *ca.* 3 050 m, 22 - VI - 1994, coll. ZHANG Wen-xia.

Distribution: China (Yunnan).

Relationship: This species belongs to *denticeps* species-group, resembles the foregoing new species *Lordiphosa grucollara*, but can be distinguished from the latter in the special structure of gonopod, i.e.,

the gonopod of this new species is specifically with a slender process on caudoventral corner.

Etymology: Referring to the caudoventral process of gonopod.

3 *Lordiphosa incidens* sp. nov. (Fig.4: A - E)

Diagnosis: Gonopods (Fig.4: D, E) fused, caudoventrally notched, ventral lobes pubescent marginally. Paramere (Fig.4: D, E) bow-shaped in lateral view, caudodorsal process bifurcated apically, lower one curved ventrally, with a long setae dorsally at the bifurcation point.

Head: Eye dark red, with thin piles. Ocellar triangle brown; ocelli dark yellow. Frontal vitta light brown; without interfrontal setulae. Fronto-orbital plate light brown. Face light brown; carina low, anteriorly reaching half part of facial region. Clypeus brown. Gena light brown. Occiput dark brown. Pedicel light brown, with 2 stout setae; 1st flagellomere paler; terminal bifurcation of arista moderate. Palpus yellow, with 1 prominent apical seta.

Thorax: Scutum dark red mostly, brown between dorsocentral setae, with a brown stripe extending nearly the entire length of scutum in the middle; with a pair of stripes outside dorsocentral setae, extending only 1/3 of the entire length of scutum from caudal margin. Scutellum brown except for dark yellow margin. Mesopleuron light brown. Postpronotal lob light brown; postpronotal setae 2, lower one slightly longer. Acristichal setulae in 6 rows. Basal scutellar setae divergent; apicals convergent and crossed.

Wing: Hyaline, dark yellow. Veins brown; r-m and dm-cu crossveins clear. R_{2+3} slightly curved to costa at tip. R_{4+5} and M_1 parallel. C_1 setae 2, subequal. Halter whitish yellow.

Legs: Dark yellow. Apical setae on fore and mid tibiae; preapical setae on all tibiae. Fore 1st tarsomere slightly longer than 3 succeeding tarsomeres together; mid and hind 1st tarsomeres as long as the rest together.

Abdomen: Tergites brown. Sternites brown.

Male Terminalia: Epandrium (Fig.4: A) broad,

dark yellow, nearly entirely pubescent except for anterior margin and ventral lobe; with *ca.* 16 setae laterally and dorsally; ventral lobe with *ca.* 6 marginal setae. Surstylus (Fig.4: A, C) with *ca.* 7 apically-pointed primary prensisetae arranging in slightly concave row on half upper part of distal margin, with *ca.* 4 primary prensisetae arranging in slightly convex row on half lower part of distal margin; with a few spines on inner surface and a few setulae caudoventrally. Cercus (Fig.4: A, B) oval, entirely pubescent; with *ca.* 21 long setae; ventral margin truncated, with a row of *ca.* 7 dark brown teeth. Hypandrium (Fig.4: D, E) somewhat triangular, without paramedian spines. Aedeagus (Fig.4: D, E) short, distally somewhat dilated and hirsute. Apodeme (Fig.4: D, E) dark yellow, slightly longer than aedeagus.

Measurements (mm): BL = 2.39 (2.32 - 2.48); ThL = 1.21 (1.16 - 1.26); WL = 2.78 (2.70 - 2.90); WW = 1.21 (1.20 - 1.22).

Indices: arb = 3 - 5/0 - 1; FW/HW = 0.52 (0.50 - 0.55); ch/o = 0.30 (0.30 - 0.31); prorb = 0.92 (0.86 - 1.00); rorb = 0.28 (0.22 - 0.35); vb = 0.43 (0.38 - 0.47); dcl = 0.64 (0.60 - 0.71); sctl = 1.24 (1.19 - 1.34); sterno = 0.54 (0.48 - 0.65); orbito = 0.38 (0.33 - 0.43); dcp = 0.62 (0.52 - 0.70); sculp = 1.24 (1.17 - 1.29); C = 3.86 (3.75 - 4.00); 4c = 0.59 (0.55 - 0.63); 4v = 1.53 (1.41 - 1.60); 5x = 1.48 (1.38 - 1.63); ac = 1.92 (1.78 - 2.04); M = 0.44 (0.42 - 0.50); C3F = 0.47 (0.43 - 0.50).

Holotype: ♂, China, Lüchun, Yunnan Province, alt. *ca.* 1 670 m, 10 - III - 1995, coll. ZHANG Wen-xia.

Paratype: 3♂, same data as holotype.

Distribution: China (Yunnan).

Relationship: This species belongs to *denticeps* species-group, resembles *Lordiphosa falsiramula* (Zhang et Liang, 1992), but can be distinguished from the latter in the diagnostic characters such as the notch on caudoventral margin of gonopod.

Etymology: Referring to the notch on caudoventral margin of gonopod.

4 *Lordiphosa piliferous* sp. nov. (Fig.5: A - E)

Diagnosis: Paramere (Fig.5: D, E) bow-shaped in lateral view, caudodorsal part slender, apically bifurcated, longer branch hirsute apically.

Head: Eye dark red, with thin piles. Ocellar triangle dark yellow; ocelli yellow. Frontal vitta light brown. Fronto-orbital plate dark yellow, with a few setulae. Face dark yellow; carina high, anteriorly reaching half part of facial margin. Clypeus dark yellow. Gena dark yellow. Occiput brown. Pedicel light brown, with 2 stout setae; 1st flagellomere paler; terminal bifurcation of arista moderate. Palpus dark yellow, with 1 prominent apical seta.

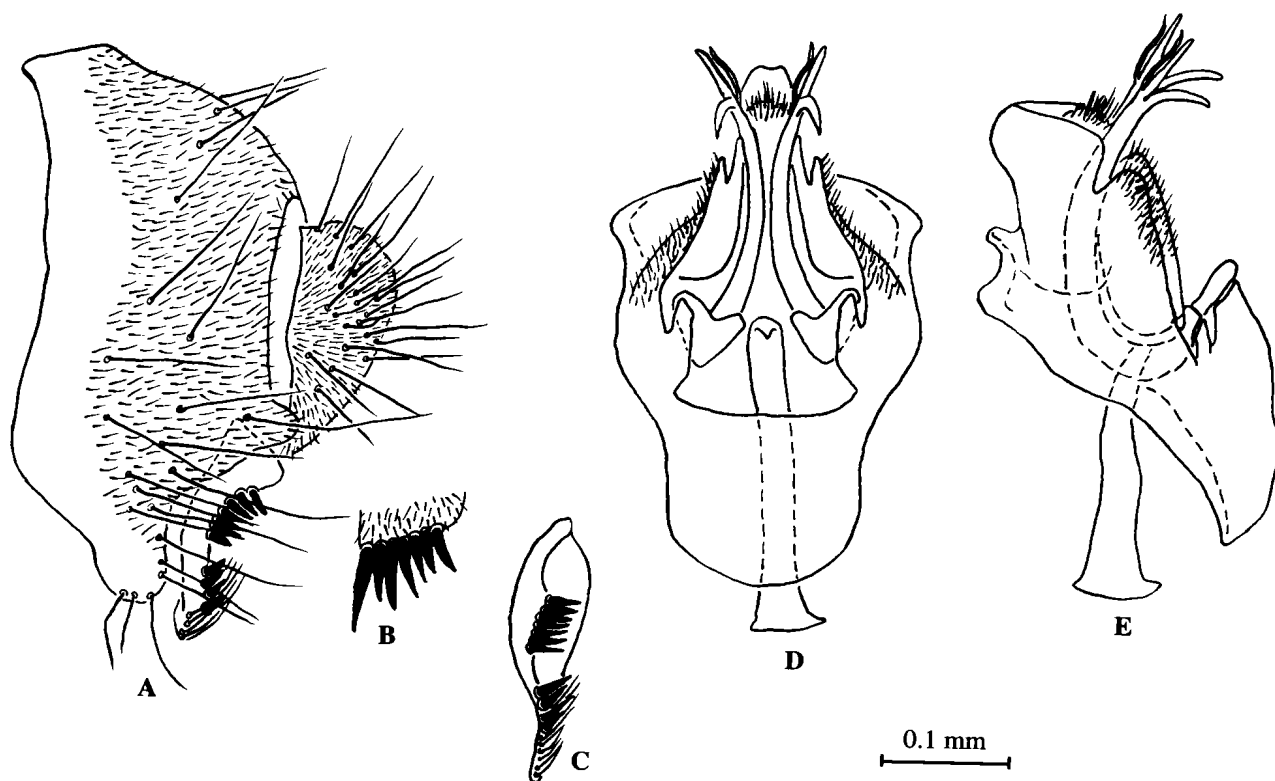
Thorax: Dark yellow. Postpronotal lob dark yellow; postpronotal setae 2, lower one longer. Acrostichal setulae in 6 rows. Basal scutellar setae divergent; apicals convergent and crossed.

Wing: Hyaline, dark yellow. Veins brown; r-m and dm-cu crossveins clear. R₂₊₃ slightly curved to costa at tip. R₄₊₅ and M₁ parallel. C₁ setae 2, subequal. Halter whitish yellow.

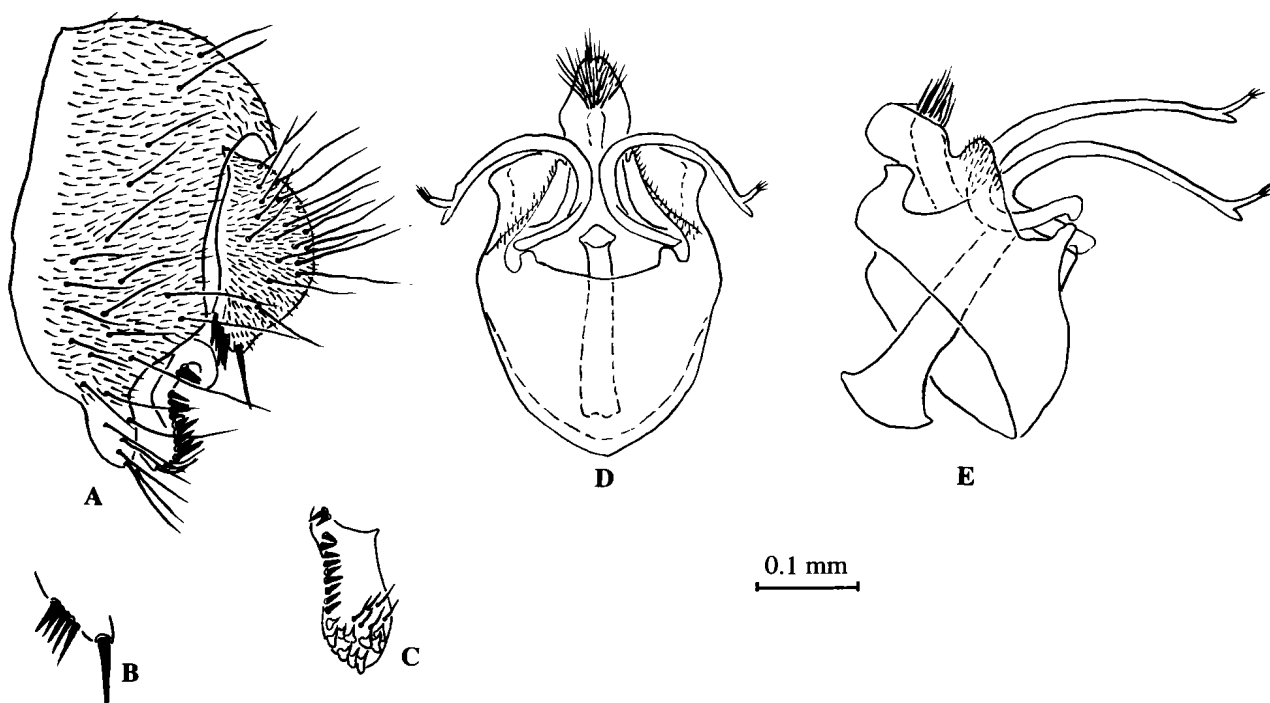
Legs: Dark yellow. Apical setae on fore and mid tibiae; preapical setae on all tibiae. Fore 1st tarsomere as long as 3 succeeding tarsomeres together; mid and hind 1st tarsomeres as long as the rest together.

Abdomen: Tergites brown. Sternites brown.

Male Terminalia: Epandrium (Fig.5: A) nearly entirely pubescent except for anterior margin and ventral lobe; with *ca.* 16 setae laterally and dorsally; ventral lobe narrow, with *ca.* 8 setae. Surstylus (Fig.5: A, C) with *ca.* 11 primary prensisetae arranging in concave row on half upper part of distal margin, submedially not continuous; with a few spines on inner surface and a few garlic-shaped teeth caudoventrally. Cercus (Fig.5: A, B) oval, entirely pubescent; with *ca.* 18 setae; ventral margin with 1 stout apical tooth and 5 lateral teeth. Hypandrium (Fig.5: D, E) somewhat triangular, without paramedian spines. Gonopods (Fig.5: D, E) fused, with pubescent processes caudoventrally. Aedeagus (Fig.5:

Fig.4 *Lordiphosa incidens* sp. nov.

A. Epandrium, cercus and surstylus, in lateral view; B. Cercus (ventral part); C. Surstylus; D. Aedeagus, paramere, apodeme, gonopod and hypandrium, in ventral view; E. Aedeagus, paramere, apodeme, gonopod and hypandrium, in lateral view.

Fig.5 *Lordiphosa piliferous* sp. nov.

A. Epandrium, cercus and surstylus, in lateral view; B. Cercus (ventral part); C. Surstylus; D. Aedeagus, paramere, apodeme, gonopod and hypandrium, in ventral view; E. Aedeagus, paramere, apodeme, gonopod and hypandrium, in lateral view.

D, E) hirsute apically. Apodeme (Fig.5: D, E) brown, slightly longer than aedeagus.

Measurements (mm): BL = 2.44; ThL = 1.17; WL = 2.76; WW = 1.1.

Indices: arb = 5/1; FW/HW = 0.49; ch/o = 0.28; pror = 0.95; ror = 0.27; vb = 0.47; del = 0.63; setl = 1.22; sterno = 0.45; orbito = 0.46; dep = 0.59; setlp = 1.12; C = 4.10; 4c = 0.62; 4v = 1.77; 5x = 1.63; ac = 2.09; M = 0.50; C3F = 0.48.

Holotype: ♂, China, Mount Huanglian,

Lüchun County, Yunnan Province, alt. ca. 1 880 m, 9 - III - 1995, coll. ZHANG Wen-xia.

Distribution: China (Yunnan).

Relationship: This species belongs to *denticeps* species-group, resembles the foregoing new species *Lordiphosa incidens*, but can be distinguished from the latter in the diagnostic characters, especially in the character that the longer branch of paramere is apically hirsute.

Etymology: Referring to the longer branch of paramere apically hirsute.

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